FINAL PROGRESS REPORT

During the last phase of NAG 2-386 we completed three studies. The effects of 14 days of weightlessness; the vastus medialis (VM) from flight rats in COSMOS 2044 was compared with the VM from tail suspended rats and other controls. The type I and II fibers in the mixed fiber portion of the VM were significantly reduced in flight rats and capillary densities paralleled the fiber density changes. The results of this project compared favorably with those in the extensor digitorum longus following seven days of flight in SL 3.

The cardiovascular projects focused on the blood pressure changes in head down tilted rats (HDT) and non-head down tilted (N-HDT) rats. Blood pressures (MAP, SP and DP) were significantly elevated through seven days of HDT and rapidly returned to control levels within one day after removal from the HDT position. The N-HDT showed some slight rise in blood pressure but these were not as great and they were not as rapid. The HDT rats were characterized as exhibiting transient hypertension. These results led to some of the microvascular and vascular graduate student projects of Dr. Bernhard Stepke. Also our results refute or, at least, do not agree with previous reports from other laboratories. Each animal, in our blood pressure projects, served as its own control thereby providing more accurate results. Also, our experiments focused on recovery studies which can, in and of themselves, provide guidelines for flight experiments concerned with blood pressure changes.

Another experiment was conducted to examine the role of testicular atrophy in whole body suspended (WBS) and tail suspended (TS) rats. We worked in conjunction with Dr. D.R. Deaver's laboratory at Pennsylvania State University and Dr. R.P. Amann at Colorado State University. In the TS rats the testes are retracted into the abdominal cavity, unless a ligature is placed to maintain them in the external scrotal sac. The cryptorchid condition in TS rats results in atrophy of the testes and lowered levels of spermatid formation. Hormonal changes due to testes atrophy must be considered in future experiments where related effects may modify muscle, bone or other tissue changes. Also, some new assessments of past results (published by many researchers) may warrant revised interpretations.

The blood pressure studies and the testicular function results were presented and reviewed during an invited lecture at the University of Bordeaux II during the Animals in Space Symposium in March 1993.

In summary, each of these three projects complied with the objectives of the proposal and serve to demonstrate the utility of animal models in preparations and interpretations of space flight results. All funding has been expended in accordance with the approved budget.

Research Publications and Presentations

(November 1990 through April 1993)

Manuscripts

Musacchai, X.J., J.M. Steffen, R.D. Fell, M.J. Dombrowski, V.W. Oganov, and E.I. Ilyina-Kakueva. J. Applied Physiol. 73(2), Suppl.:44S-50S, 1992.

Musacchai, X.J., J.M. Steffen, and J. Dombrowski. Rat cardiovascular responses to whole body suspension: Head-down and non-head-down tilt. J. Applied Physiol. 73(4): 1504-1509, 1992.

Deavers, D.R., R.P. Amann, R.H. Hammerstedt, R. Ball, D.N.R. Veeramachaneni, and X.J. Musacchia. Effects of caudal elevation on testicular function in rats: Separation of effects on spermatogenesis and steroidogenesis. J. Andrology 13(3):224-231, 1992.

Stepke, B., J.T. Fleming, I.G. Joshua and X.J. Musacchia. Alterations in skeletal muscle microcirculation of the head-down tilted rat. Aviation Space and Environmental Medicine (Submitted)

Stepke, B., J.T. Fleming, I.G. Joshua, and X.J. Musacchia. Altered arterial vasoconstrictor responsiveness following whole body suspension. (In preparation)

Abstracts

Stepke, B., J.T. Fleming, I.G. Joshua and X.J. Musacchia. Simulated weightlessness in rats influences arterial vasoconstrictor responsiveness. FASEB J. (4), Part II:A667 (#3864), 1993.

Symposium & Seminar Presentations

Bernhard Stepke. Altered vascular responsiveness in the whole body suspended rat. Department of Physiology, University of Missouri, Columbia, October 1992.

X.J. Musacchia. Invited Lecture. Symposium on Animals in Space. University of Bordeaux II, March 1993

Report Enclosures

Manuscript reprints

Musacchia, X.J., J.M. Steffen, R.D. Fell, M.J. Dombrowski, V.W. Oganov, and E.I. Ilyina-Kakueva. J. Applied Physiol. 73(2), Suppl.:44S-50S, 1992.

Musacchia, X.J., J.M. Steffen, and J. Dombrowski. Rat cardiovascular responses to whole body suspension: Head-down and non-head-down tilt. J. Applied Physiol. 73(4): 1504-1509, 1992.

Deavers, D.R., R.P. Amann, R.H. Hammerstedt, R. Ball, D.N.R. Veeramachaneni, and X.J. Musacchia. Effects of caudal elevation on testicular function in rats: Separation of effects on spermatogenesis and steroidogenesis. J. Andrology 13(3):224-231, 1992.

Stepke, B., J.T. Fleming, I.G. Joshua and X.J. Musacchia. Alterations in skeletal muscle microcirculation of the head-down tilted rat. Aviation Space and Environmental Medicine (Submitted)